Electrical Hazards

Before entering tree or commencing work on any site, an inspection shall be conducted by a Qualified Arborist to determine if an electrical hazard exists

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Electrical Hazards

An electrical hazard exists whenever:

- Any part of the worker approaches within 10 feet of any energized equipment
- Any part of tree being worked is within 10 feet
- Any part of tree will pass within 10 feet
- Any tool or equipment will come within 10 feet

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Electrical Hazards

All conductors (electric, telephone, CTV, guywires, etc.) shall be considered to be energized with potentially fatal voltages

- Other objects may be energized, especially after storms or accidents
  - guy wires, fences, telephone lines, highway barriers vines, trees, etc.
- Impossible to look at a wire or object and determine if energized and voltage

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Electrical Hazards

Low Voltage: 120 volts in house service can kill you

- Carries more than enough amps.

Voltage Recognition

Tree workers must be able to recognize maximum potential voltage

- Plan work accordingly – proper minimum separation distance

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Inspection

All Tree Workers shall inspect the tree and site to identify potential electrical hazard

- Utility
- Municipal
- Private
- Commercial

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Inspection

Identify tree contacts

- Burned, brown leaves near conductors
- Ends of twigs and branches burned
- Unnatural notch or flat area in tree crown near conductors
- Burned wood in branch near conductor.

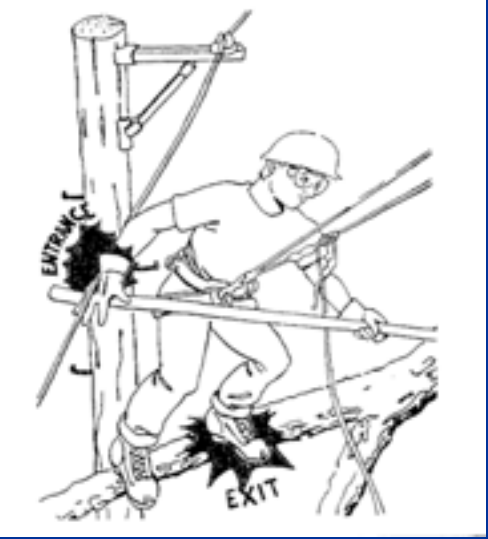
Electrical Contact

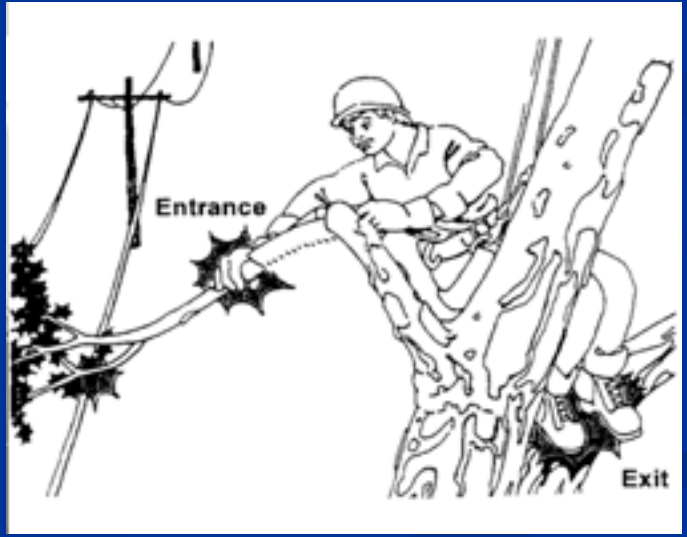
Direct contact

- Any part of the body touches an energized conductor

Indirect contact

- Any part of the body contacts a conductive object in contact with an energized conductor
  - Tree limb, palm frond, tool, etc.





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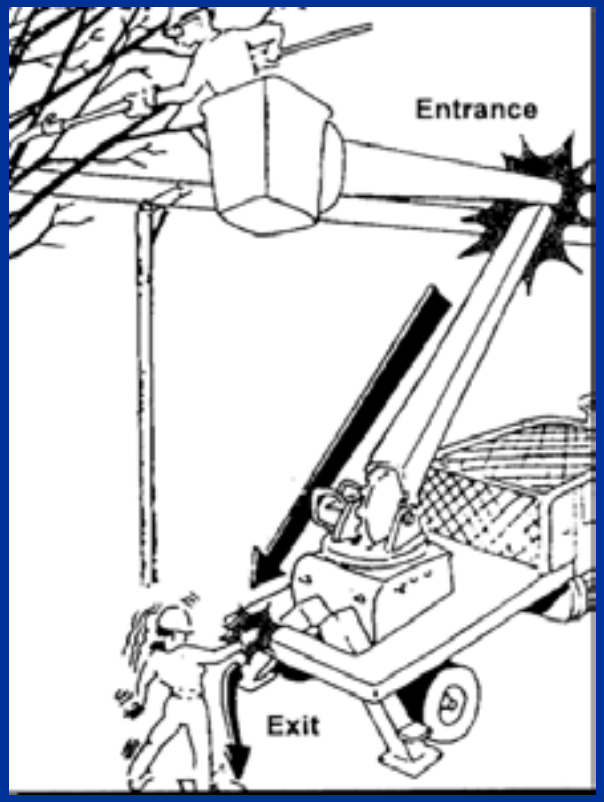
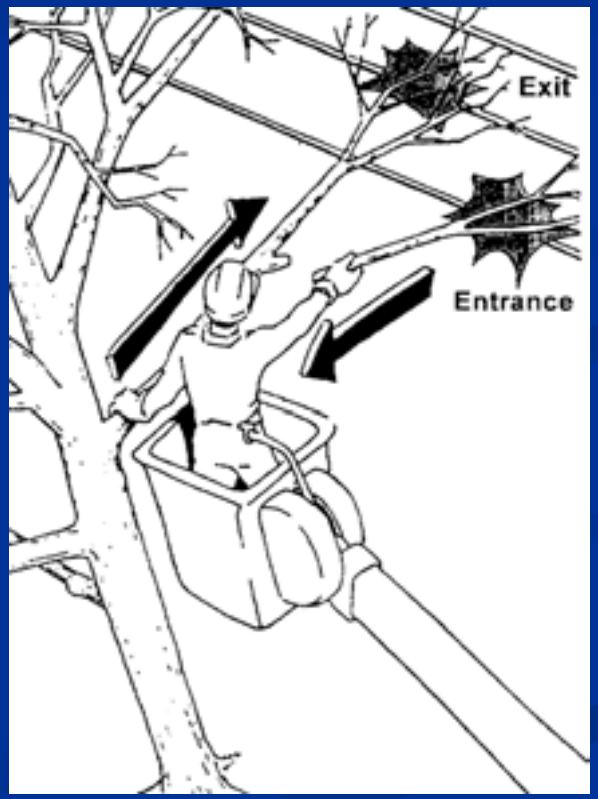
Electrical Contact

Direct or indirect contacts may permit bypass of safety devices

- Insulated booms and tools
- Phase to phase or phase to ground contacts





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Electrical Contact

Physical contact may not be required under certain conditions

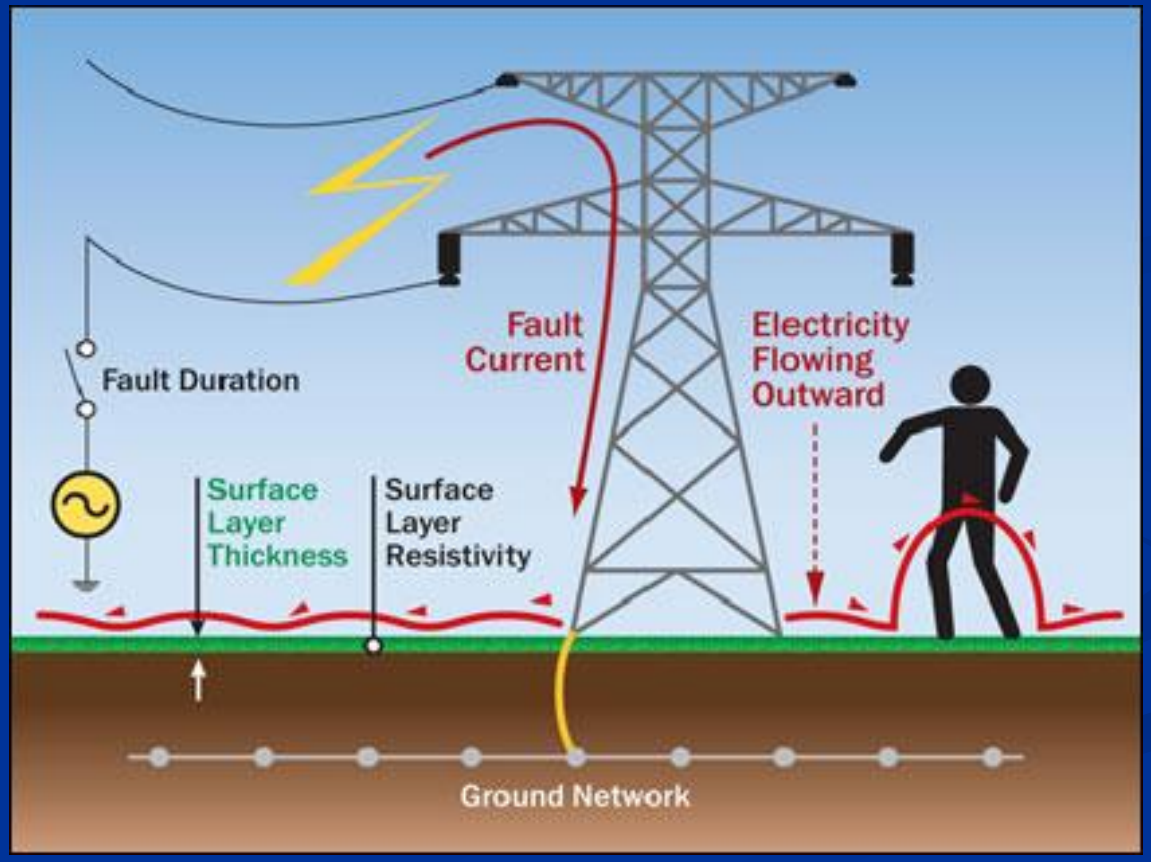
- High voltages
- Wet conditions
  - Rain
  - High humidity

Electricity can jump (arc) to make contact and complete circuit

- Arc temperature can reach 10,000 degrees

Electrical Contact

Step potential occurs when large amounts of electrical energy go to ground and create an uneven ground potential



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Working Near Utility Lines

If not contracted by owner/operator of energized electrical equipment (utility company, others)

- If qualified, must contact them prior to commencing any work within 10 feet of energized electrical equipment (> distance if voltage > 50kV)
- If not qualified, cannot conduct work within MAP

Hawaiian Electric Company, Inc.

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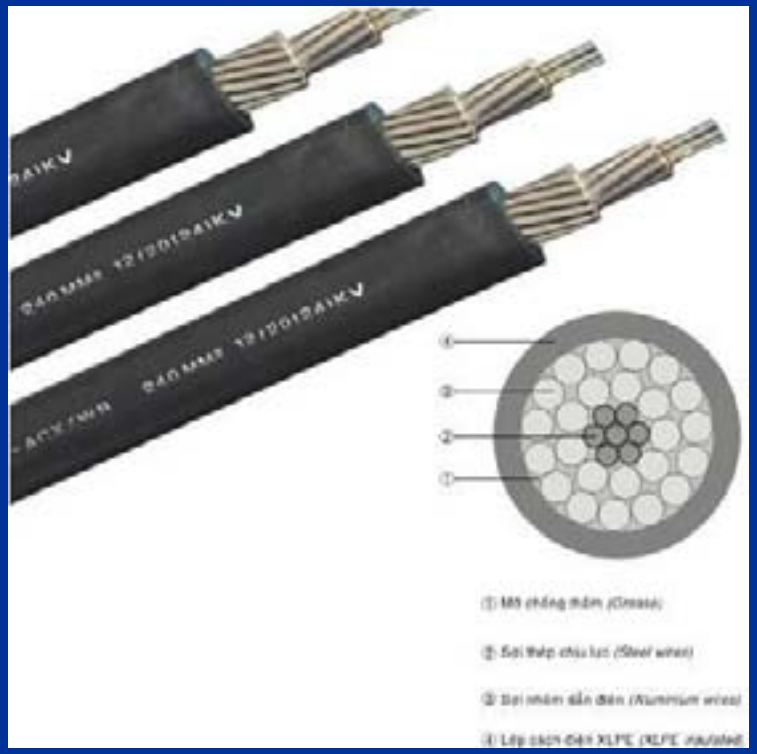
Working Near Utility Lines

Wire coverings never considered insulated

- **MAD for voltage always maintained**



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Qualified Personnel

ONLY Qualified Line-Clearance Arborists and Qualified Line-Clearance Arborist Trainees can work within 10' of energized equipment (Further for voltages > 50 kV)

- All other workers must maintain at least 10' clearance at all times
- Includes:
  - Person
  - Tools
  - Aerial lift
  - Any part of tree being worked

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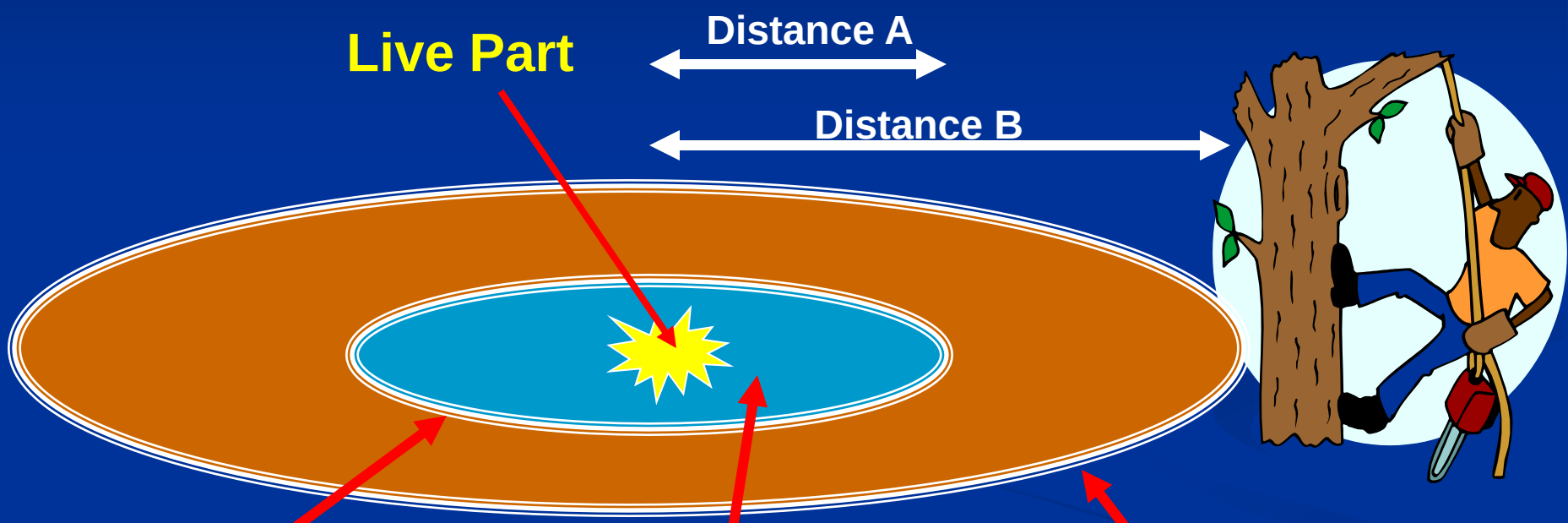
Working Near Utility Lines

Always maintain >/= Minimum Approach Distances



Qualified workers must stay this far away (Distance A)

"No Go" area!

Non-qualified workers must stay this far away (Distance B)

Diagram by Tree Care Industry Association

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Minimum Approach Distances
Non Qualified Personnel

Table 2 – Minimum approach distances to energized conductors for persons other than qualified line-clearance arborists and qualified line-clearance arborist trainees

Nominal voltage kV phase-to-phase[1)]	Distance	
	ft-in	m
0.0 – 1.0	10-00	3.05
1.1 – 15.0	10-00	3.05
15.1 – 36.0	10-00	3.05
36.1 – 50.0	10-00	3.05
50.1 – 72.5	10-09	3.28
72.6 – 121.0	12-04	3.76
138.0 – 145.0	13-02	4.00
161.0 – 169.0	14-00	4.24
230.0 – 242.0	16-05	4.97
345.0 – 362.0	20-05	6.17
500.0 – 550.0	26-08	8.05
785.0 – 800.0	35-00	10.55

[1)] Exceeds phase-to-ground.

Minimum Approach Distances for Qualified Line-clearance Arborists and Trainees

Table 1 - Minimum approach distances from energized conductors for qualified line-clearance arborists and qualified line-clearance arborist trainees

Nominal voltage in kilovolts (kV) phase-to-phase	Includes 1910.269 elevation factor, sea level to 5000 ft.*		Includes 1910.269 elevation factor, 5001 - 10,000 ft.*		Includes 1910.269 elevation factor, 10,001 – 14,000 ft.*	
	ft-in	m	ft-in	m	ft-in	m
0.051 to 0.3	*Avoid contact*		*Avoid contact*		*Avoid contact*	
0.301 to 0.75	1-01	0.33	1-03	0.38	1-04	0.41
0.751 to 15.0	2-05	0.70	2-09	0.81	3-00	0.88
15.1 to 36.0	3-00	0.91	3-05	1.04	3-09	1.00
36.1 to 46.0	3-04	1.01	3-10	1.16	4-02	1.09
46.1 to 72.5	4-02	1.26	4-09	1.44	5-02	1.30
72.6 to 121.0	4-06	1.36	5-02	1.55	5-07	1.68
138.0 to 145.0	5-02	1.58	5-11	1.80	6-05	1.96
161.0 to 169.0	6-00	1.80	6-10	2.06	7-05	2.23
230.0 to 242.0	7-11	2.39	9-00	2.73	9-09	2.95
345.0 to 362.0	13-02	3.99	15-00	4.56	16-03	4.94
500.0 to 550.0	19-00	5.78	21-09	6.60	23-07	7.16
765.0 to 800.0	27-04	8.31	31-03	9.50	33-10	10.29

* Exceeds phase-to-ground; elevation factor per 29 CFR 1910.269.

Note: At time of publication, the minimum approach distances in this table for voltages between 301 and 1,000 volts exceed those specified by 29 CFR 1910.269, in anticipation of OSHA adopting these distances during the life of ANSI Z133.1-2006.

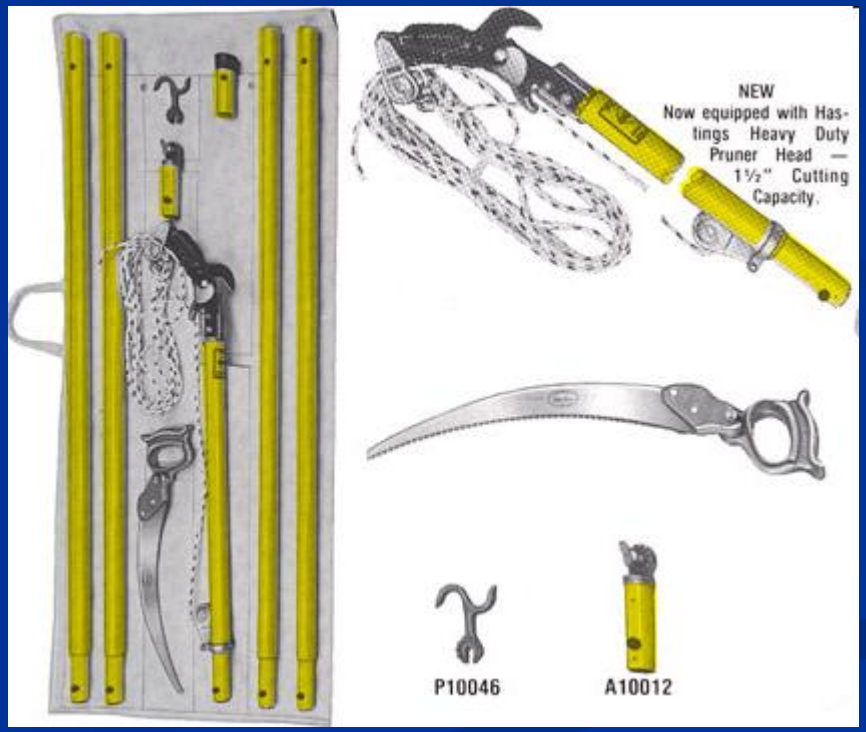
Non-Qualified or MAD Not Possible

Contact equipment owner/operator

- De-energize and ground energized equipment
- Cover with insulated, protective covering to shield workers
- Move energized equipment away from worksite, outside MAP
- Conduct work by qualified line workers.

Tools and Equipment

Use only tools and equipment designed, manufactured or approved for use near energized electrical equipment



Tools and Equipment

Non-conductive tools must be kept clean and dry

- **Dirt and wet increase conductivity**

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Tools and Equipment

Aerial lifts

- Inspected daily
- Cleaned with non-film cleaning agent
- Use only non-conductive hydraulic fluid
- Never alter bucket or boom
- Never fasten wire or conductive objects on boom
- Dielectric tested at specified intervals – ANSI A92.2
- Maintain MAD at all times

Tools and Equipment

Ladders

- Metal or other conductive materials shall not be used

Tools and Equipment

Linemen's gloves, footwear or other electric resistant equipment shall not be considered as electrical contact protection

General Work Practices

All work must always be conducted to avoid:

- Contact with energized electrical equipment
- Encroachment within the applicable MAD

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General Work Practices

- Maintain constant awareness of location of conductors
- Do not work with back to conductor
- Always know the location of the conductors and face that direction
- Do not conduct any work that cannot be completed safely.

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Aerial Lift Procedures

- Always face direction bucket is moving – toward lines
- Whenever possible, enter on side away from conductors
- Never squeeze bucket between conductors

Aerial Lift Procedures

- Never drill holes in bucket
- Prevent groundperson from contacting truck and chipper until boom in safe position away from conductors
    - Do not operate the chipper until boom clear of lines

Aerial Lift Procedures

Always maintain Minimum Approach Distances.

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Climbing Procedures

- Position tie-in to prevent entry within MAD
- Select tie-in that prevents swing into lines
    - Never tie-in over lines
- Whenever possible, climb on side away from conductors
- Do climb over lines
- Do not place weight on limb to cause line contact

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Pruning/Felling Practices

- Limbs that may contact conductors should be cut back first with a nonconductive tool
- If cannot be cut back, must be pulled back or lowered with a rope to prevent contact with conductor
- Cut short lengths of wood to fall between lines

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Pruning/Felling Practices

Use ropes and equipment to control wood

- Control tree/limb to prevent contact with conductors
  - May permit removal of large limbs faster and safer
- Rigging most advanced tree work techniques
- Only experienced workers should perform rigging
- New techniques should be practiced before application

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Weather

Weather can increase electric hazards

- Wet trees, tools and equipment become more conductive
- Wet atmosphere increases conductivity of air
- Wind can cause limbs and trees to move unexpectedly
  - Use ropes to ensure fall control

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Weather

Extra caution and attention required during bad weather

- Increased risk of trees and conductors down
- Be alert for energized fences, fallen limbs, ground, etc
- Never assume that conditions are safe

Weather

Storm Restoration Work

- Work prohibited during storms
- Thorough jobsite inspection necessary
- Treat all downed lines as energized
- Fences, gutters, anything conductive can be “hot”
- Beware of generator feedback

Generator Back-Feed Hazard

1. Storm knocks out electricity
2. Homeowner connects generator directly into house wiring without isolating it from in-coming lines
3. Electricity from generator "back-feeds" through house wiring breaker box, meter, house drop and transformer
4. Transformer that usually steps 7,200 volts down to 120 volts ***steps up*** 120 volts from generator to 7,200 volts sending it into storm-damaged distribution circuit
5. Unsuspecting arborist contacts tree or line and is electrocuted

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Underground Work

- Stump grinding
- Trenching
- Planting
- Any digging

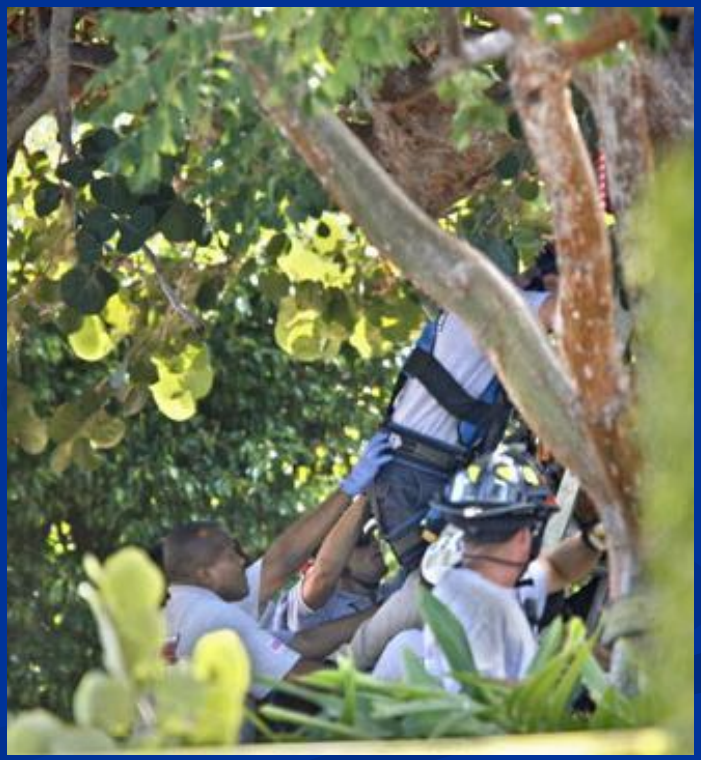
- Facilities can be at any depth

- Utility or locating service must be called.

Electrical Accident Root Cause

The root cause of electrical contacts/accidents is:

- Inadequate inspection
- Lack of diligence
- Loss of control
  - Tools
  - Branches/fronds.



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Only Use Qualified Workers and Always Maintain Proper Minimum Approach Distance!

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